REMARKS/ARGUMENTS

Claims 2-32 are pending in this application. Claims 2-32 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point our and distinctly claim the subject matter which applicant regards as the invention. Claims 2-32 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements.

Claims 2-30 are rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter. Claims 2-32 are rejected under 35 U.S.C. 101 as lacking patentable utility.

Claims 2, 4-15, and 17-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng (US Patent No. 6,658,071) in view of Ross et al. (US Patent No. 6,128,765). Claims 3 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng and Ross et al. in view of Crozier et al. (US Patent No. 6,145,114). Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng and Ross et al. in view of Benedetto et al. "Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes".

Rejections under 35 U.S.C. § 112

Indefiniteness

Claims 2-32 are rejected under § 112, second paragraph, as being indefinite. Applicants earnestly thank the Examiner for providing suggested amendments for claims 2, 15, and 29-32 to improve clarity and definiteness. Applicants have amended claims 2, 15, and 29-32 according to the Examiner's suggestions and believe that with these amendments, claims 2-32 overcome the rejections under § 112.

Structural cooperative relationship

Claims 2-32 are rejected under § 112, second paragraph, as incomplete for omitting essential structural cooperative relationships of elements. Specifically, the Examiner indicates that such relationship has not been established between "digital information" and "higher confidences information." As amended, claims 2-32 no longer recite "digital information" and therefore overcome the rejection.

Rejections under 35 U.S.C. § 101

Statutory subject matter

Claims 2-30 are rejected under § 101 as being directed to non-statutory subject matter. As currently amended, claims 2-30 recite methods and systems for updating soft decision information *based on at least one observed signal* into higher confidence information. The recited methods and systems fall squarely within the statutorily defined categories of "process" and "machine," respectively, which are patentable under 35 U.S.C. § 101. Furthermore, because claims 2-30, as amended, are directed to methods and systems for updating soft decision information based on an observed signal, they are not directed to "an abstract algorithm performed on the basis of an abstract," which the Examiner has indicated would constitute non-statutory subject matter. Applicants respectfully submit that claims 2-30 as currently amended are directed to statutory subject matter and therefore overcome the rejection.

Patentable utility

Claims 2-32 are rejected under § 101 as lacking patentable utility, because the claims supposedly fail to set forth a relationship between "digital information" and "higher confidence information. As amended, claims 2-32 no longer recite "digital information" and overcome the rejection for at least that reason.

In addition, claims 2-32 as amended also clearly set forth the relationship between "higher confidence information" and other recited terms. Specifically, "higher confidence information" is clearly identified as the result of updating "soft decision information," which in turn is based on "at least one observed signal."

Clearly, the updating of soft decision information based on an observed signal into higher confidence information has useful, practical applications. One of these applications is the implementation of a data communication system in which transmitted symbols must be decoded based on an observed signal, as described in the present application at pp. 4-5. Updating of soft decision information on such symbols into higher confidence information allows decisions on the symbols to be made with greater accuracy and less error, which improves the performance of the data communication system. Of course, other applications such as data

storage systems also exist. Thus, claims 2-32, as currently amended, provide significant patentable utility and overcome the rejection.

Rejections under 35 U.S.C. § 103

Claim 2

Cheng and Ross et al. cannot be combined in the manner proposed by the Examiner to arrive at the present invention as recited in claim 2. Claim 2 recites, amongst other features, "performing backward recursion calculations on said reduced-state trellis representation using said input soft decision information to produce backward state metrics, wherein said backward recursion does not take into account decisions on said FSM inputs generated from said forward recursion."

Cheng discloses a reduced-state trellis representation algorithm in which the processing of a backward recursions is dependent on the processing of a forward recursion. The Examiner alleges that Fig. 6 of Cheng shows a backward recursion (steps 74-80) performed independently of a forward recursion (steps 66-72). However, upon closer inspection of the description of Fig. 6, it is revealed that the backward recursion performed at step 74 implements equation 24 or equation 37, both of which explicitly require results produced by the forward recursion. See Cheng, col. 14, lines 6-8 ("The second loop 64 begins at a block 74 that performs the backward recursion. The backward recursion implements equation 24 (37) for each state i."); col. 10, lines 8-10 ("That is, the backward recursion does not hypothesize feedbacks and instead re-uses the modified received sequence $\hat{r}_n(i)$ computed by the forward recursion.") (describing equation 24); and col.12, lines 54-56 ("That is, the backward recursion does not hypothesize feedbacks and instead re-uses the modified received sequence $\hat{r}_n(i)$ computed by the forward recursion.") (describing equation 37). Thus, the disclosure of Cheng, including Fig. 6 cited by the Examiner, clearly teaches a backward recursion that is dependent on a forward recursion.

Ross et al. discloses a full-state trellis representation algorithm in which the processing of a backward recursions is independent of the processing of a forward recursion. Independent processing of the forward and backward recursions as disclosed in Ross et al. relies

on the fact that a full-state trellis representation allows state transition metrics to be calculated prior to any forward recursion or backward recusion. See Ross et al., col. 2, equation 6 (showing transition metrics $\gamma_k(m'+m)$ calculated prior to any forward or backward recursion). When forward and backward recursions are processed, they use the same pre-calculated transition metrics. See Id., col. 3, equation 9 (showing forward recursion using pre-calculated transition metrics $\gamma_k(m'+m)$) and equation 10 (showing forward recursion using pre-calculated transition metrics $\gamma_k(m+m')$). This technique is only feasible under the presumption that a full-state trellis representation is used.

It is impossible to adopt the independent processing of forward and backward recursions taught in Ross et al. into Cheng because Ross et al.'s technique for independent processing of forward and backward recursions requires a full-state trellis representation, as described above. In Cheng, such a full-state trellis representation cannot be presumed because Cheng is based on a reduced-state trellis representation. No state transition metrics can be calculated prior to the forward recursion and backward recusions, given Cheng's reduced-state trellis representation. Ross et al.'s independent processing of forward and backward recursions, based on pre-calculated state transition metrics, are thus inapplicable to Cheng. Accordingly, Cheng cannot be modified to incorporate Ross et al.'s teachings on forward and backward recursions performed independently of each other without requiring information on decisions made during the recursion, as proposed by the Examiner.

Indeed, Cheng actually teaches away from the present invention as recited in claim 2. Cheng identifies what it considers to be "major issues" that may be created by the independent processing of forward and backward recursions in a reduced-state trellis representation. See Cheng, col. 2, lines 36-65. For example, Cheng is concerned that independent processing of forward and backward recursion in a reduced-state trellis representation would generate inconsistencies in forward and backward decision feedback data (referred by Cheng as "DFE" symbols). See Id. The solution Cheng proposes to address this "major issue" is to re-use the decisions generated from the forward in the backward recursion, to avoid this inconsistency in the decision feedback data. See Id., col. 4, lines 53-58 ("The same reduced state space is used by the backward recursion. Using this structure, the decision

feedback side information for the backward recursion is not associated with the surviving paths in the backward trellis, but rather is determined by the forward recursion..."). Thus, Cheng explicitly teaches away from the present invention of claim 2, which recites "performing backward recursion calculations on said reduced-state trellis representation using said input soft decision information to produce backward state metrics, wherein said backward recursion does not take into account decisions on said FSM inputs generated from said forward recursion."

Accordingly, Applicants submit that Cheng cannot be modified to incorporate the teachings of Ross et al. as proposed by the Examiner. Further, Cheng explicitly teaches away from the invention as recited in claim 2. For these reasons, it is believe that claim 2 is patentable over Cheng in view of Ross et al.

Claims 15, 29, and 30

Claims 15, 29, and 30 each recites features relating to "performing backward recursion calculations on said reduced-state trellis representation using said input soft decision information to produce backward state metrics, wherein said backward recursion does not take into account decisions on said FSM inputs generated from said forward recursion" and have been rejected on similar grounds as claim 2. For at least the reasons stated above with regard to claim 2, claims 15, 29, and 30 are also patentatble over Cheng in view of Ross et al.

Claims 31 and 32

Claims 31 and 32 each recites features relating to "performing backward recursion calculations on said reduced-state trellis representation using said input soft decision information to produce backward state metrics, wherein said backward recursion does not take into account decisions on said FSM inputs generated from said forward recursion" and have been rejected on similar grounds as claim 2. For at least the reasons stated above with regard to claim 2, claims 31 and 32 are also patentatble over Cheng, Ross et al., in view of Benedetto et al.

Claims 3-14 and 16-28

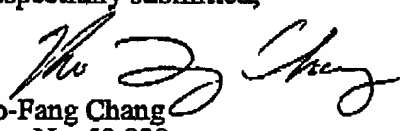
Claims 3-14 and 16-28 depend from claims 2 and 15, respectively, and each incorporates all of the limitations of its corresponding independent claim. As such, claims 3-14 and 16-28 are also patentable for at least the reasons stated above with regard to claims 2 and 15.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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